Small Business Innovation Research/Small Business Tech Transfer

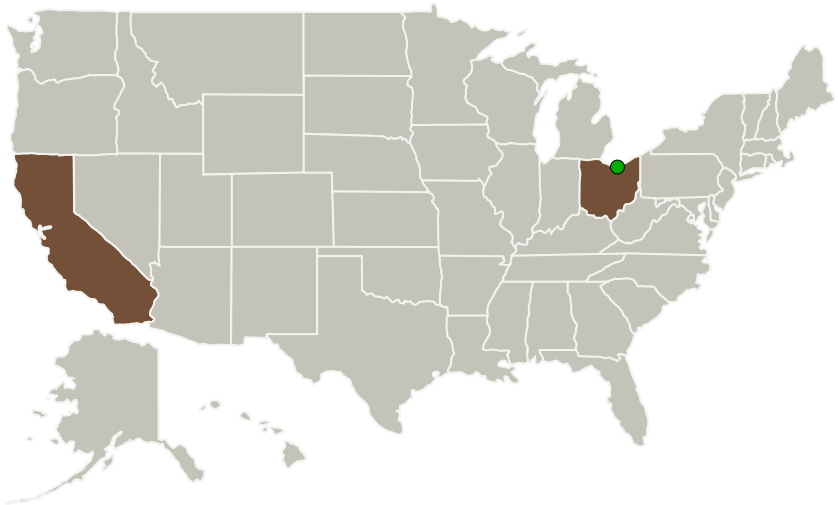
Hybrid-Electric Aircraft TOGW Development Tool with Empirically-Based Airframe and Physics-Based Hybrid Propulsion System Component Analysis, Phase I

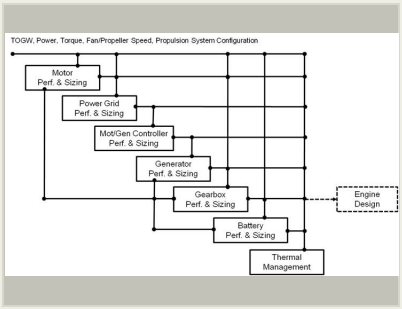
Completed Technology Project (2013 - 2013)

Project Introduction

Hybrid-Electric distributed propulsion (HEDP) is becoming widely accepted and new tools will be required for future development. This Phase I SBIR proposal creates a turbo-electric, hybrid electric propulsion system sizing and weight synthesis tool specifically designed for use in an MDAO framework. It will offer significant flexibility regarding placement of the propulsive devices for top-level hybrid design, including over-wing, under-wing, split-wing, fuselage pylon-mounted, and other configurations. The user will supply power required, fan speed, fan torque, TOGW estimation, desired power split between engines and batteries, and selection for propulsion system locations. Sizing and weight analysis for electric motors, generators, speed controllers, gearboxes, cables, transformers, batteries, and cooling systems will be considered including structural considerations for heavily modified aircraft components for each system. The outputs will be hybrid electric propulsion system weight, sizes for the sub-system components, and revised HEDP specific TOGW calculation. The overall goal of this proposal is to provide a tool within a framework for top-level and conceptual hybrid electric propulsion studies. Additionally, the fidelity of the current NASA models is based on empirical-data and extrapolations. This proposed tool will employ physic-based models with empirical corrections, when needed. A Phase II and future commercialization plan have been identified.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Empirical Systems Aerospace, Inc.(ESAero)	Lead Organization	Industry	Pismo Beach, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

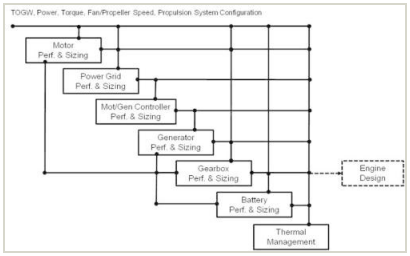
May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138614)*

Images



Project Image
Hybrid-Electric Aircraft TOGW Development Tool with Empirically-Based Airframe and Physics-Based Hybrid Propulsion System Component Analysis *(https://techport.nasa.gov/image/127887)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Empirical Systems Aerospace, Inc. (ESAero)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Andrew Gibson

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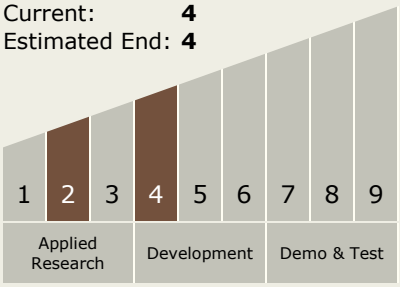
Completed Technology Project (2013 - 2013)

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.2 Modeling
    - TX11.2.1 Software Modeling and Model Checking

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System